

CHAPTER 660 BASE AND SUBBASE

Topic 661 - Engineering Considerations

Bases and Subbases serve as a support for the surface layer and distribute the wheel load to subgrade material.

In addition to functioning as part of the pavement structure, they serve the following functions:

- To slow down the intrusion of fines from the subgrade soil into the higher layer material.
- Minimize the damage of frost action.
- Preventing the accumulation of free water within or below the pavement structure.
- Providing a working table for construction equipment.

Topic 662 - Base and Subbase Categories

Index 662.1 Aggregate Base and Subbase

Aggregate bases and subbases consist of a combination of sand, gravel, crushed stone and recycled material. They are classified in accordance with their gradation and the amount of fines. The gradation of the aggregates can affect structural capacity, drainage, and frost susceptibility. The quality of aggregate base and subbase material affects the rate of load distribution and drainage.

662.2 Treated Base and Subbase

- (1) *Hot Mixed Asphalt Base (HMAB)*. Depending on the quality of aggregate, HMAB is classified as dense graded Type A or Type B Hot Mix Asphalt, (HMA). Type A is primarily a crushed aggregate, which provides greater stability than Type B. When used with HMA pavement, the HMAB is to be considered as part of the pavement layer. The HMAB will be assigned the same gravel

factor, G_r as the remainder of the HMA in the pavement structure.

- (2) *Other Treated Bases and Subbases*. Treated bases and subbases are materials mixed with asphalt, portland cement, or other stabilizing agents to improve the strength or stiffness of granular material. These materials include lean concrete base (LCB), cement treated base (CTB), asphalt treated base (ATB) and lime treated subbase (LTS). CTB has shown poor performance under rigid pavement in the past. CTB exhibit excessive pumping, faulting, and cracking. This is most likely due to impervious nature of the base, which traps moisture and yet can break down and contribute to the movement of fines beneath the slab.

662.3 Treated Permeable Base and Subbase

Treated permeable bases (TPB) provide a strong, highly permeable drainage layer within the pavement structure. The binder material may be either asphalt (ATPB) or portland cement (CTPB). Either of these TPB layers will generally provide greater drainage capacity than is needed. The standard thickness is based primarily on constructability with an added allowance to compensate for construction tolerances. If material other than ATPB and CTPB with a different permeability, it is necessary to check the permeability and adequacy of the layer thickness. TPB must be used in accordance with a positive sub-drainage system per Index 651.2.

Erosion and stripping (water washing away cement paste, binders, and fines) can be an issue for TPB. Because of this, the Department no longer recommends CTPB for new pavement structures.

Topic 663 - Engineering Criteria

Because different types of treated and untreated aggregates have different capacities for resisting the forces imposed by traffic, this factor must be considered when determining the thickness of the pavement elements. For rigid pavement, this is considered in the design catalogs found in Topic 623. Table 663.1A provides the base and subbase

material properties used for the Rigid Pavement Catalog. For flexible pavement it is accomplished with California R-value and G_f , which expresses the relative value of various materials when compared to gravel. Table 663.1B provides the G_f and California R-values used for engineering flexible pavements.

The final selection of the bases and subbases for a given project depends on specific factors relative to the available materials, terrain, climate, and past performance of the pavement under similar project or area conditions and economics.

Since pavement engineering is a continually evolving field, the District Materials Engineer should be contacted for the latest guidance in base and subbase materials among other related engineering considerations.

Table 663.1A

Base and Subbase Material Properties for Rigid Pavement Catalog

HMA Type A Properties	
Aggregate gradation	0% retained $\frac{3}{4}$ inch sieve 32% retained $\frac{3}{8}$ inch sieve 52% retained No. 4 sieve 5.5% passing No. 200 sieve Conventional viscosity grade of AC 10
AC binder	70 °F
Reference temperature	0.35
Poisson's ratio	11.662%
Effective binder content	8%
Air voids	149 lb/ft ³
Total unit weight	8.05 Btu-in/h-ft ²
Thermal conductivity asphalt	0.23 Btu/lbm-°F
Heat capacity asphalt	2
Base erodibility index ⁽¹⁾	
LCB Properties	
Unit weight	150 lb/ft ³
Poisson's ratio	0.20
Elastic Modulus	2.00 x 10 ⁶ psi
Thermal conductivity	15 Btu-in/h-ft ²
Heat capacity	0.28 Btu/lbm-°F
Base erodibility index ⁽¹⁾	1
AB / AS Properties	
Poisson's ratio	0.40
Coefficient of lateral pressure, K ₀	0.5
Resilient Modulus	43,500 psi/29,000 psi
Plasticity Index	1
Passing No. 200	3%
Passing No. 4	20%
D ₆₀	0.315 inch
Base erodibility index ⁽¹⁾	4

Note:

(1) Base erodibility index is classified as:

- Extremely erosion resistant material
- Very erosion resistant material
- Erosion resistant material
- Fairly erodible material
- Very erodible material

Table 663.1B
Gravel Factor and California R-values for Bases and Subbases

Type of Material	Abbreviation	California R-value	Gravel Factor (G_f)
Aggregate Subbase	AS-Class 1	60	1.0
	AS-Class 2	50	1.0
	AS-Class 3	40	1.0
	AS-Class 4	specify	1.0
	AS-Class 5	specify	1.0
Aggregate Base	AB-Class 2	78	1.1
	AB-Class 3	specify	1.1 ⁽¹⁾
Asphalt Treated Permeable Base	ATPB	NA	1.4
Cement Treated Base	CTB-Class A	NA	1.7
	CTB-Class B	80	1.2
Cement Treated Permeable Base	CTPB	NA	1.7
Lean Concrete Base	LCB	NA	1.9
Hot Mixed Asphalt Concrete Base	HMAB	NA	(2)
Lime Treated Subbase	LTS	NA	0.9+UCS/1,000

Notes:

- (1) Must conform to the quality requirements of AB-Class 2.
- (2) When used with HMA, the HMAB is to be considered as part of the pavement layer. The HMAB will be assigned the same G_f as the remainder of the AC in the pavement structure.

Legend:

NA = Not Applicable

UCS = Unconfined Compressive Strength in psi